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IN THE

Supreme Court of the United States

OCTOBER TERM, 1930.

No. 630.

DeFOREST RADIO COMPANY, Petitioner,

v.

GENERAL ELECTRIC COMPANY, Respondent.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT.

RESPONDENT'S BRIEF IN REPLY TO BRIEF OF AMICI CURIAE.

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Supreme Court of the United States

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No. 630. LANGMUIR PATENT 1,558,436.

DeForest Radio Company, Petitioner,

v.

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ON WRIT OF CERTIORARI TO THE CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT.

RESPONDENT'S BRIEF IN REPLY TO BRIEF OF AMICI CURIAE.

The brief of the *amici curiae* is inconsistent with itself as well as with that of petitioner. In one mood it repeats the petitioner's fallacious play on the words "harmful" ionization and "satisfactory" operation. In another mood it admits the difference between the DeForest tube and the Langmuir tube; that the Langmuir tube operates with a pure electron discharge (p. 21), and admits that the ionization in a DeForest tube affects the current (p. 8). It labors through five pages to show how easy it ought to have been

for one skilled in the art to modify a DeForest audion so that it would be a Langmuir tube, which means of course to take the tube which petitioner's witnesses prove was "entirely unsuited for telephone repeater service" (Vol. I, 1. 413) because it would not handle an ordinary telephone conversation (Vol. I, p. 519) and make it into the tube which is today handling long-distance telephone conversation all over the world.

It contends that if Langmuir's tube is not the identical tube of the prior art, it is a natural and obvious development which any one skilled in the art would perceive and realize. The argument is predicated on a kind of reasoning which would destroy any patent which ever has been issued. It is also predicated on a complete indifference to the facts—to such facts as that DeForest obviously was unable to do what is now said to have been so easy and so obvious. As this Court said in *Diamond Rubber Co.* v. *Consol. Rubber Tire Co.*, 220 U. S. 428 at p. 434,

> "Its simplicity should not blind us as to its character. Many things, and the patent law abounds in illustrations, seem obvious after they have been done, and, 'in the light of the accomplished result,' it is often a matter of wonder how they so long 'eluded the search of the discoverer and set at defiance the speculations of inventive genius.' (Pearl *v.* Ocean Mills *et al.*, C. D., 1877, 133; 11 O.G., 2; Barn. & A., 469; Fed. Cas., 10,876.) Knowledge after the event is always easy, and problems once solved present no difficulties, indeed, may be represented as never having

had any, and expert witnesses may be brought forward to show that the new thing which seemed to have eluded the search of the world was always ready at hand and easy to be seen by a merely skilful attention. But the law has other tests of the invention than subtle conjectures of what might have been seen and yet was not. It regards a change as evidence of novelty, the acceptance and utility of change as a further evidence, even as demonstration."

To the Chemical Foundation in 1931 what Langmuir did in 1912 seems natural, simple and obvious. To the art of 1912 it would have seemed heresy—which is just what it seemed to DeForest as late as 1915 (main brief, p. 28). As we have pointed out in our main brief, the workers in the art firmly believed that gas was necessary to the operation of a hot-cathode tube. The fact that a "hard" audion was useless confirmed that view. So also did the best scientific opinion of 1912. (Vol. II, pp. 21, 1133-37: I. R., pp. 1507-1522; 1925-1930, 1372, 509; Vol. II, I. R., 1135; Vol. III, pp. 1509-1513; I. R., p. 2121, 272 Fed., page 397: main brief, pp. 27-28.)

Under these circumstances to suggest in 1912 that taking out the gas would avoid some of the evils which beset the user of a DeForest tube, would have been like suggesting that cutting a man's tongue out would cure him of stuttering.

The whole argument is also obviously destroyed by Lilienfeld's admitted failure to make an operative hot-cathode X-ray tube *after* his 1910 work (I. R., p. 1400) and by the fact that he was obliged to

fall back on gas conduction to make the X-ray tube of his patent 1,222,010. We do not believe, as the *amici curiae* suggest, that he ultimately produced a pure-electron-discharge tube, after Langmuir and Coolidge had succeeded, but before he knew of their success. But if he did it does not lead to the conclusion suggested, for if the theory of the *amici curiae* were correct he could have done it anytime after 1910.

Lilienfeld's hot-cathode tube failed because it was gassy (I. R., p. 1400). Either he believed, as others did, that the gas was essential, or he was unable to overcome the difficulties inherent in a hot-cathode high-vacuum tube, difficulties which the art did not know how to overcome (Vol. III, pp. 1726-1729, 1913; Vol. II, p. 1269; I. R., p. 2057). Millikan's views to the contrary are based upon the fact that the experience of that eminent scientist was with tubes in which the difficulties did not appear, for he had no experience with hot-cathode tubes (I. R., p. 144, lines 10-26 and pp. 1242-61). We have seen in our main brief, pp. 80-81, that these difficulties were too much for Arnold. Nobody knew how to achieve a high vacuum *maintainable during the operation of a hot-cathode tube.* It was not a pump that they needed, for the pumps that they had were good enough (Vol. II, p. 1711; I. R., pp. 2044-2045, 1491 and 882); it was the "know how." As Langmuir said at I. R., p. 1277:—

> "the degree of vacuum at which a device is sealed off is of very minor importance as compared to the condition of the walls of the tube

and the condition of the electrodes. That is, the amount of gas which is contained in a vacuum tube, even if the pressure at the time of sealing off is 1000th of a millimeter, is very small in comparison with the amount of gas that may be liberated from the walls of the tube and from the electrodes during operation of the tube, unless very special precautions have been taken to eliminate these sources of gas."

At page 1283, I. R., he said:—

"It is an entirely different matter, as we have seen from the experiment with the 'nickel anode tube,' *when heated electrodes are present.* In that case it is necessary to heat the electrodes to a very high temperature and for relatively long periods of time during exhaustion. In fact, it is necessary to carry the treatment of the electrodes in our ordinary present-day thermionic devices to a point which no one had any conception of prior to 1912."

At page 1249, I. R., he said:—

"The point that I want to make is simply that the characteristics of our modern thermionic devices are so fundamentally different and they had been so little studied by workers outside of the industrial laboratory that practically no one realized that the older and prevalent ideas as to discharges in vacuum were not applicable to them."

We refer also to Vol. III, pp. 1726, 1662-1664; Vol. II, pp. 1270-1276; I. R., pp. 1489-1491 and 1280. Those most skilled in the art were satisfied that any hot-cathode tube must necessarily develop quan-

tities of gas in operation (I. R., pp. 1426, 1280, 1288-1289).

The Langmuir invention is not a matter of degree; it is the elimination of an element upon which the operation of the prior art devices depended. The difference between a DeForest audion and a Langmuir tube is not a difference in the part which gas plays in their operation; the difference is that the audion depended upon gas for its operation whereas in the Langmuir tube gas plays no part whatever. Langmuir took out the variable (gas) of the prior art devices and put a constant in its place.

Of course there is no "sudden beginning or sudden stoppage of ionization" (*a. c.* brief, p. 21); of course by gradually introducing gas into a Langmuir tube we could change its operation from that of the pure electron discharge to that of the DeForest audion by imperceptible gradations, just as by mixing paints we might pass from the jet black of India ink to the whiteness of a clean sheet of paper by imperceptible gradations. But black is black and white is white, and the Langmuir tube, with its marvelous capabilities, is a different tube from the DeForest tube—operating on a different principle and producing different results.

There is no case in the books where a change of this sort has been held to be a change of degree. The law on this subject is laid down by this Court in many decided cases, such as the *Eibel Process* case, 261 U. S. 45, and the *Minerals Separation* case, 242 U. S. 261.

Langmuir's invention is not a principle. Langmuir discovered a new principle, but he invented and produced a new tube. It is the new tube which his patent covers,—a tube which, because of its construction, operates in accordance with that principle, just as the paper-making machine in *Eibel* v. *Minnesota*, 261 U. S. 45, operated on a new principle because of its construction. Langmuir's claims are just as detailed and definite as those of the patent in the *Eibel* case.

The Chemical Foundation appeared for the first time in this case after the decision of U. S. Circuit Court of Appeals, as one of the *amici curiae*. The statements of fact made on its behalf in the opening pages of the brief are therefore, of course, outside the record. Under the circumstances we felt that it was proper and only fair to inform the Court at the hearing as to the position taken by the Chemical Foundation, when its interest was the encouragement of American scientific research and invention, rather than the destruction of a meritorious patent resulting from such research and invention.

Under the circumstances we hope and believe that it is proper to refer to the same matter here.

In the year 1925 this same Chemical Foundation published and widely circulated a pamphlet entitled "What Price Progress," in which it said, in a chapter entitled "Science in Industry":—

> "Mention the names of *Langmuir*, Coolidge, Whitney and Steinmetz in any civilized country and the well-informed man will be able to enumer-

ate some of their accomplishments. But there are hundreds of others in the employ of the General Electric Company, some of whom have contributed greatly to the store of scientific knowledge and achievement. * * *

"In addition, through its contributions to the development of the radio, it has entertained and instructed millions in this and other countries, and besides, in the development of the X-ray machine and other medical appliances, the group has alleviated suffering and made human lives happier. * * *

"The General Electric's is one industrial laboratory in which the pursuit of science is a part of the routine. Fundamental research is not merely tolerated, it is encouraged and even required. *Langmuir's development of the vacuum tube was directly due to fundamental research; that is, systematic investigation of phenomena for the purpose of discovering new facts and laws. As a result of his investigations in this field we have the vacuum tube, which gives us radio of the quality we now enjoy, transcontinental telephonic communication, the super X-ray tube of Coolidge,* and ultimately we may have the vacuum tube as a necessary link in the elongation of power transmission. * * *

"The wonders of the vacuum tube have only begun to be applied to the service of man. This great development is based on the electron theory of electricity, a purely scientific discovery. The electron is a negative particle of electricity which feels freer and more sportive in a vacuum than anywhere else. It leaps from crag to crag, that is, from filament to plate, straining itself through

the grid of DeForest. *Until Langmuir took up the study of the habits of the electron it had never known what it was to gambol in a high vacuum, having theretofore always disported itself in low vacuums.* * * *

"*Applying Langmuir's discoveries* to the X-ray, Coolidge developed a high vacuum tube known as the Coolidge X-ray tube. * * *"

Now the Chemical Foundation says that Langmuir's tube is the identical thing of the prior art as typified by the Fleming valve and the DeForest audion; now it alleges that the Coolidge X-ray tube which in the pamphlet it specifically and correctly identifies as an application of "Langmuir's discoveries" is anticipated by Lilienfeld, and infringes the Lilienfeld patent. Although its counsel say on page 3 of their brief: "The degree of vacuum shown in the Lilienfeld patents is the same as that claimed in the Langmuir patent in suit No. 1,558,436," the fact is, as admitted by petitioner's witnesses in this case and as found by Judge Thacher, that the Lilienfeld tube is a gaseous tube, depending on gas for its operation.

The Chemical Foundation sued respondent on the Lilienfeld patent 1,222,010. The bill was dismissed by Judge Thacher in the Southern District of New York, in an opinion (not yet reported) delivered March 31, 1930, affirmed on the opinion below by the Court of Appeals of the Second Circuit on May 4, 1931. Judge Thacher said in that opinion:—

"Operation of the Lilienfeld device is shown to be dependent upon ionization, and to be subject

to definite limitations when subjected to very high voltages. * * *

"Instead of employing an auxiliary hot cathode in aid of the electron discharge from a cold cathode, the Coolidge Tube eliminates ionization entirely and by the use of a hot Tungsten Cathode succeeds in producing a deluge of electrons which, under the pressure of very high voltages and without any aid from any auxiliary device, are swept across from cathode to anode in a pure electron stream."

Judge Thacher's conclusion is confirmed by the present record. Respondent's experts testify (for example at Vol. II, page 1276) and Petitioner's expert Chaffee admits, that the tube of this Lilienfeld patent operates by gas ionization; "if there were no gas ionization the current would go out" (Vol. I, page 280).

The other matters discussed in the brief of *amici curiae*, such as the alleged prior use by DeForest in California and the alleged prior invention by Arnold, for the most part mere repetition of petitioner's brief, are dealt with in our main brief.

Respectfully submitted,

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